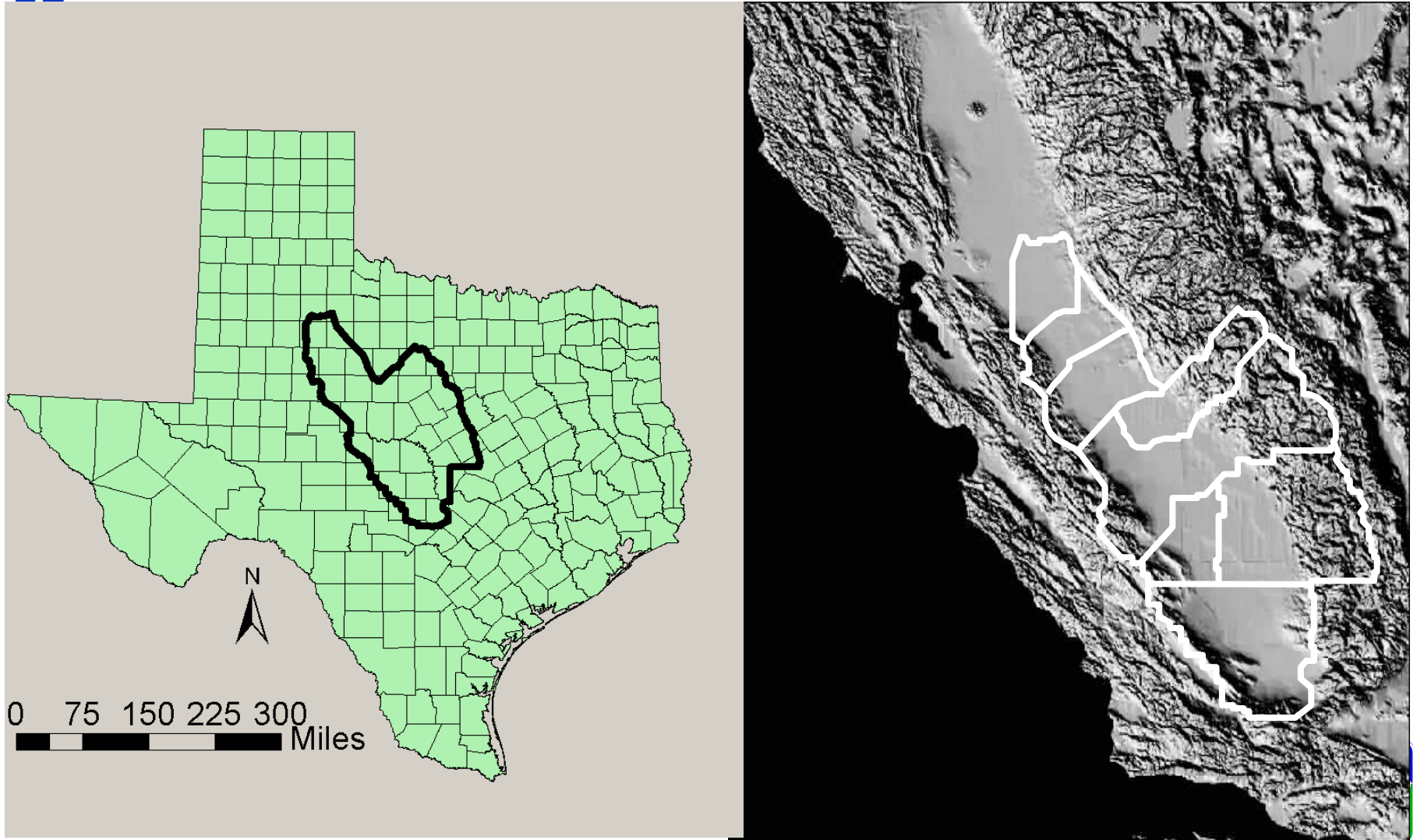


PM_{2.5} Forecasting in the San Joaquin Valley of California



The San Joaquin Valley of California



APCD Programs Supported by PM2.5 Forecasting

- AQI Forecast in 3 Regions
- Burn day and prescribed burn determination
- Please Don't Light Tonight
- Special Study Intensive Operations
- Emergency Response



Future Programs Dependent on PM_{2.5} Forecasts

- ▣ Forecasts in 23 Air Quality Forecast Areas
- ▣ Burn allocation determination in 99 zones
- ▣ Mandatory Don't Light Tonight
- ▣ Special Studies
- ▣ Emergency response



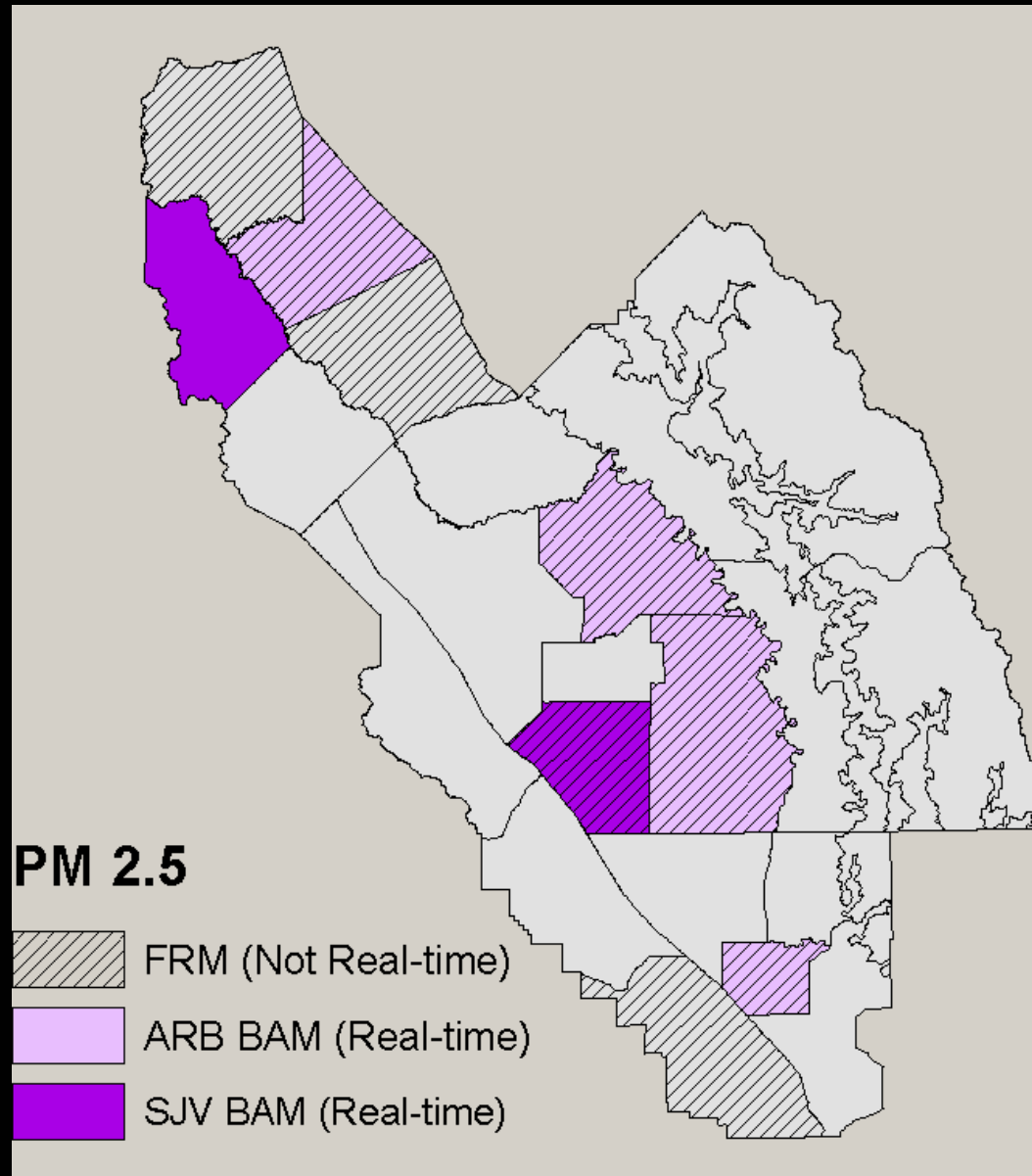
Elements of PM_{2.5}

Forecasting

- Understand PM Meteorology using Historical Synoptic and Statistical Analyses
- Understand Chemical Speciation
- Seasonal and Diurnal Emission Characteristics
- Ability to Forecast and Verify Meteorology
 - ✓ Synoptic Scale
 - ✓ Mesoscale Map
 - ✓ Transport and Dispersion



PM2.5 Data Available for Forecast Development and Verification



Winter PM2.5 Episodes In SJVAPCD

- ❑ Cold with poor vertical dispersion
- ❑ Low wind speeds
- ❑ Light fog
- ❑ Mostly PM2.5 ($>160\mu\text{g}/\text{m}^3$)
- ❑ Ammonium Nitrate ($>65\mu\text{g}/\text{m}^3$)
- ❑ Carbon



Winter Episode Chemical Composite (12/26/00-1/7/01)

For samples $>100 \text{ ug/m}^3$

- ▣ 65%-90% PM_{2.5}
- ▣ 35-61% Secondary Nitrate/Sulfate
- ▣ 14-33% Total Carbon
- ▣ 4-28% Geologic

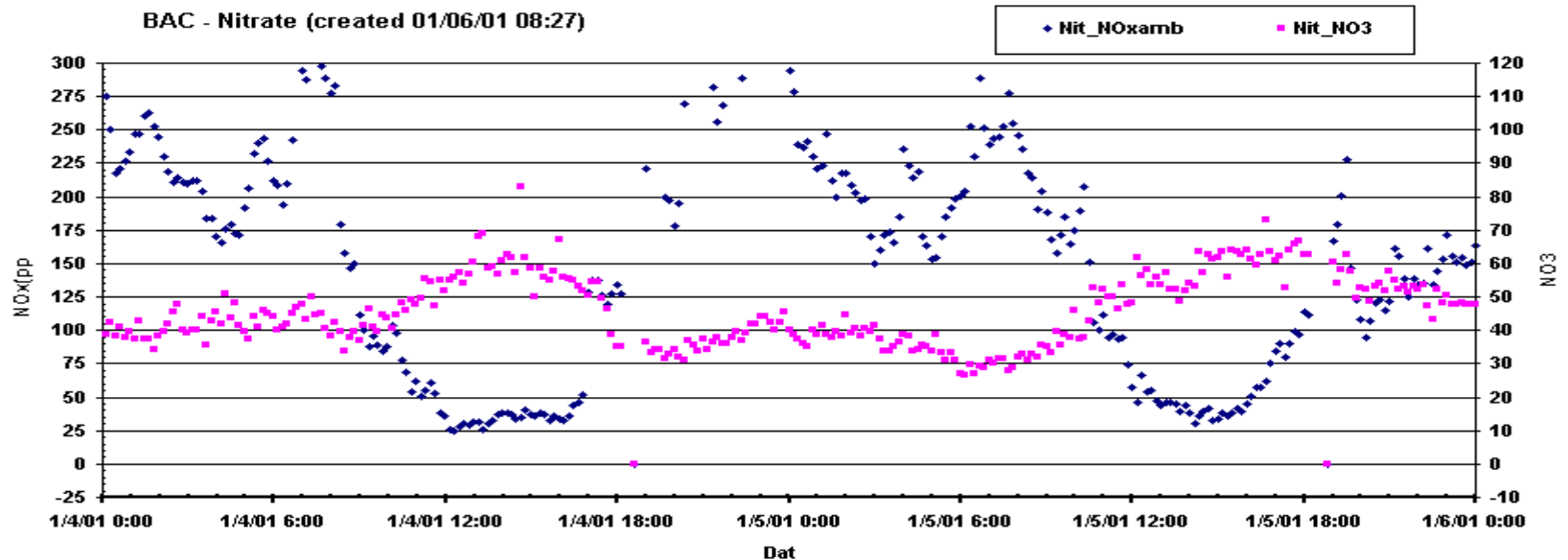
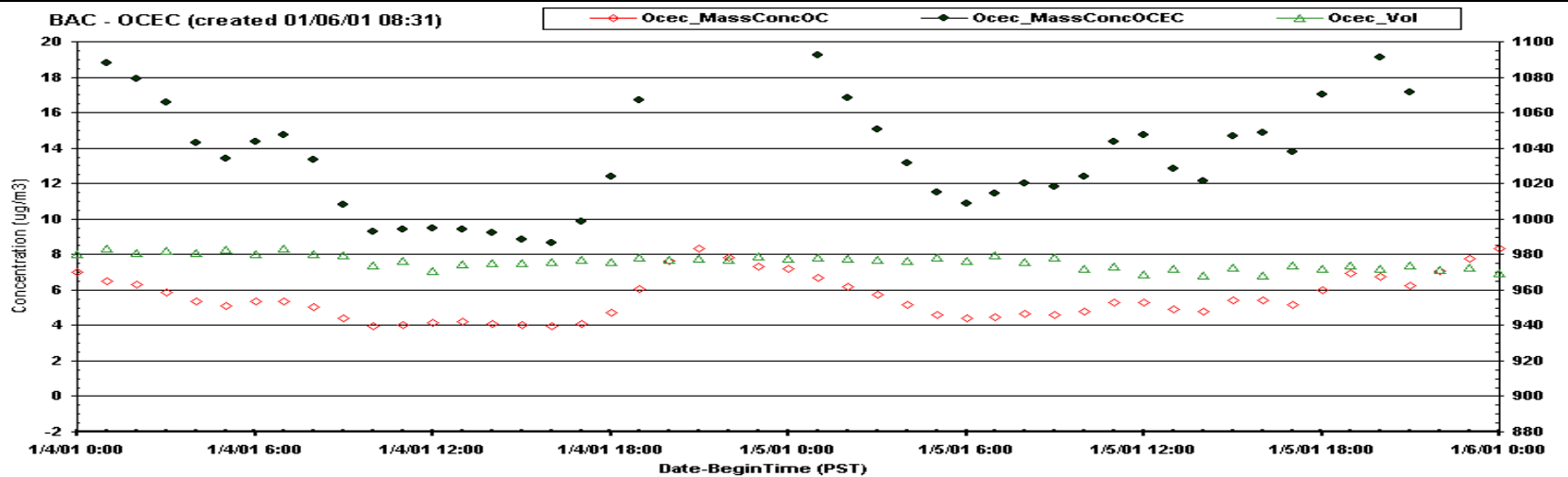


Winter Episode Meteorology

- Surface high temperatures 49 to 68 degF
- Surface minimum temperatures 30 to 37 degF
- Warm aloft, cold on the surface
- Atmospheric mixing <500 feet for 16-21 hours
- 24 hour wind speeds 1.0-4.8 mph
- Vertical dispersion extremely limited



Understanding PM2.5 Formation and Emissions



Winter Episode Synoptic Pattern

- Upper level high pressure center
 - ✓ East Pacific (2)
 - ✓ CA Coast
 - ✓ Pacific NW coast
 - ✓ Central CA
 - ✓ Nevada

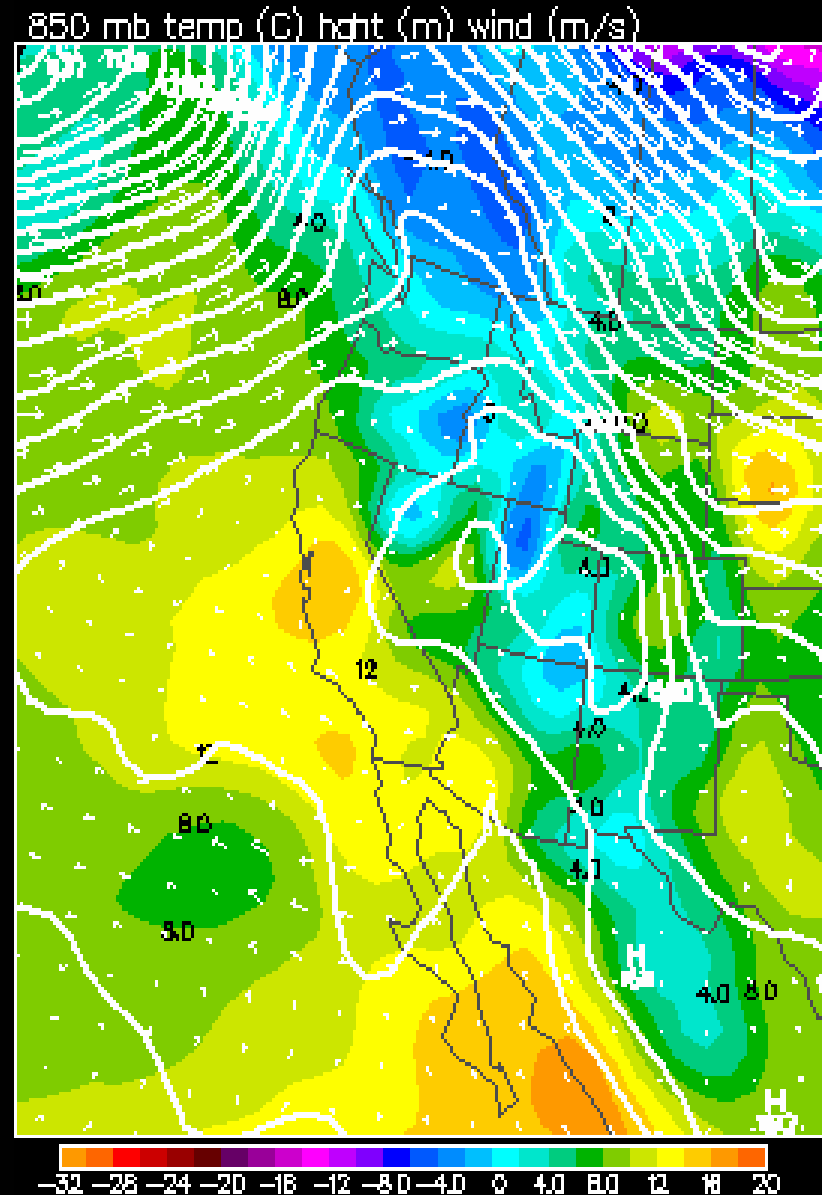
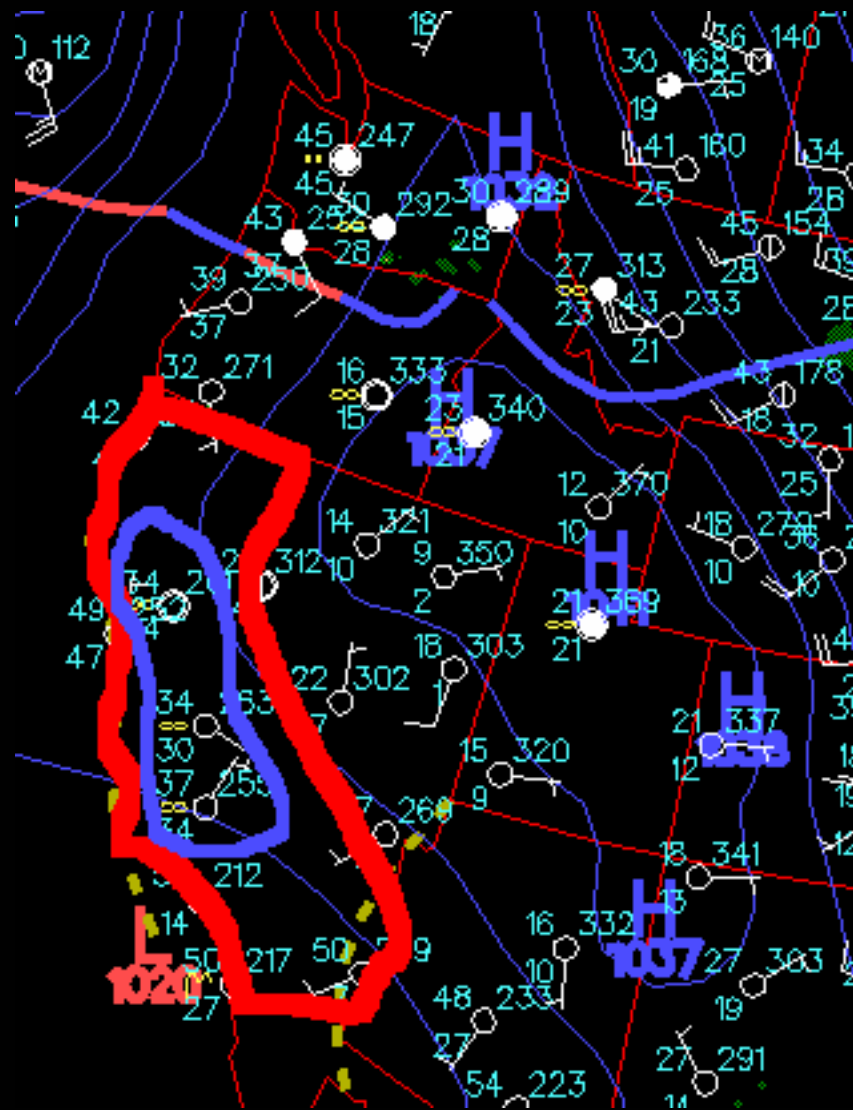


Mesoscale Prediction

- Synoptic offshore conditions lead to weak wind flows and eddy's
- High pressure indicative of subsidence and radiation inversions
- Offshore flow results in cutoff of marine air and terrain blocking
- MM5 assists in prediction of these phenomena



January 4, 2001 Surface (34 degF) and Approximate 5000 feet (61 degF)



Forecasting Tools

- ▣ **Synoptic models including MOS**
- ▣ **Mesoscale meteorological models**
- ▣ **Lower Air Profilers**
- ▣ **RAOB, aircraft, pibals**
- ▣ **Statistical Models**
- ▣ **Verification Displays**



Meteorological Parameters That the Best Linear Relationship to PM2.5 (Seasonal)

- Stability parameter (T850-Tmin)
- Average 24 hour wind speed
- Spatial maximum temperature gradient
- 500mb Temperature
- Humidity



Multiple Regression R-Met. To FRM

PM2.5

Site	Winter	Spring	Summer	Fall
Bak-CA	.76	.61	.46	.62
Bak-Air	.87	.37	.74	.79
Bak-Gol	.79	.53	.53	.63
Clovis	.39	.42	.55	.70
Corcoran	.65	.23	.46	.83
Fresno-1st	.59		.49	.62
Fresno-PC	.88	.45	.74	.77
Merced	.82	.56	.55	.72
Modesto	.74	.49	.38	.53
Stockton	.64	.51	.48	.74
Visalia	.72	.18	.54	.66




Forecast model input

Forecasting Data 1/4/2003 for 1/5/2003

Forecasted Values

Tomorrow's 12z RNO Surface Pressure	<input type="text" value="1025"/>	Tomorrow's 12z FAT 2500ft Temp (F)	<input type="text" value="51"/>
Tomorrow's 12z FAT Surface Pressure	<input type="text" value="1025"/>	Tomorrow's 12z FAT 3000ft Temp (F)	<input type="text" value="52"/>
Tomorrow's 12z LAS Surface Pressure	<input type="text" value="1022"/>	Tomorrow's 12z FAT 5000ft Temp (F)	<input type="text" value="57"/>
		Tomorrow's 12z FAT 500mb Hght (m/10)	<input type="text" value="583"/>
Tomorrow's 12z Oak 850mb Hght (m/10)	<input type="text" value="157.2"/>	* Tomorrow's 24z FAT 3000ft Temp (F)	<input type="text" value="51"/>
Tomorrow's 12z Oak 850mb Temp (C)	<input type="text" value="13.8"/>	* Tomorrow's 24z FAT 3000ft WS (m/s)	<input type="text" value="2"/>
Tomorrow's 12z Oak 850mb WD	<input type="text" value="331"/>	* Tomorrow's 24z FAT 500mb Hght (m/10)	<input type="text" value="585"/>
Tomorrow's 12z Oak 850mb WS (m/s)	<input type="text" value="5"/>		
Tomorrow's 12z Oak 850mb RH (%)	<input type="text" value="23"/>	Tomorrow's 12z MOD 3000ft Temp (F)	<input type="text" value="55"/>
Tomorrow's 12z Oak 500mb Hght (m/10)	<input type="text" value="583"/>	* Tomorrow's 24z MOD 3000ft Temp (F)	<input type="text" value="61"/>
Tomorrow's 12z Oak 500mb Temp (C)	<input type="text" value="-13"/>	* Tomorrow's 24z MOD 3000ft WS (m/s)	<input type="text" value="9"/>
Tomorrow's 12z SAC 5000ft Temp (F)	<input type="text" value="54"/>		
Tomorrow's 12z BFL 2500ft Temp (F)	<input type="text" value="52"/>		
Tomorrow's 12z BFL 5000ft Temp (F)	<input type="text" value="52"/>		

Note: Green items are used only for the Title 17 Burn Status Prediction
 * 24z tomorrow is equivalent to 0z on the day after tomorrow



Forecast Output and Edit

Microsoft Access - [Change the forecast as needed]

File Edit View Insert Format Records Tools Window Help

Air Quality Forecast

Forecast For: 1/5/2003

Site	1-hour	8-hour
Merced	36	28
Modesto	27	22
Stockton	28	21
Tracy	29	50
Turlock	33	25
Clovis	36	29
Fresno1st	27	20
FresnoDrummond	26	18
FresnoSSP	33	24
Hanford	38	28
Madera	38	29
Parlier	38	28
Arvin	38	28
Bakersfield	29	20
Edison	31	22
Maricopa	42	35
Oildale	32	24
Shafter	34	21
Visalia	32	24
LowerKaweah	40	37
AshMountain	0	0
Shaver	0	0

Site	PM10	PM2.5
Stockton:	79	64
Modesto:	84	77
Merced:	84	66
FresnoMetro/Mad:	118	87
Corcoran:	92	68
Visalia:	104	91
Bakersfield:	98	76
Maricopa:	85	NA

NorthCO:	2.4
CentralCO:	4.7
SouthCO:	1.1

SJV Simplified Title 17 Burn Status Estimate

North Conditional Burn Day

Central/South (>3000ft) No Burn Day

Central/South (<3000ft) No Burn Day

View PM10 Tile Plots

View O3 Tile Plots

View 8hr O3 Tile Plots

View MRF

Reset data to Original AQA Model Forecast

Trout 2

Print

Continue

Form View

NUM

Information Distribution

Microsoft Access - [Print and Fax]

File Edit View Insert Format Records Tools Window Help

1. Print Script and Fax	5. Send e-mail
2. Edit the Script	6. Run AQL.BAT
3. Edit the fax (send fax)	7. Update Web Pages
4. Create web pages	8. Exit Access

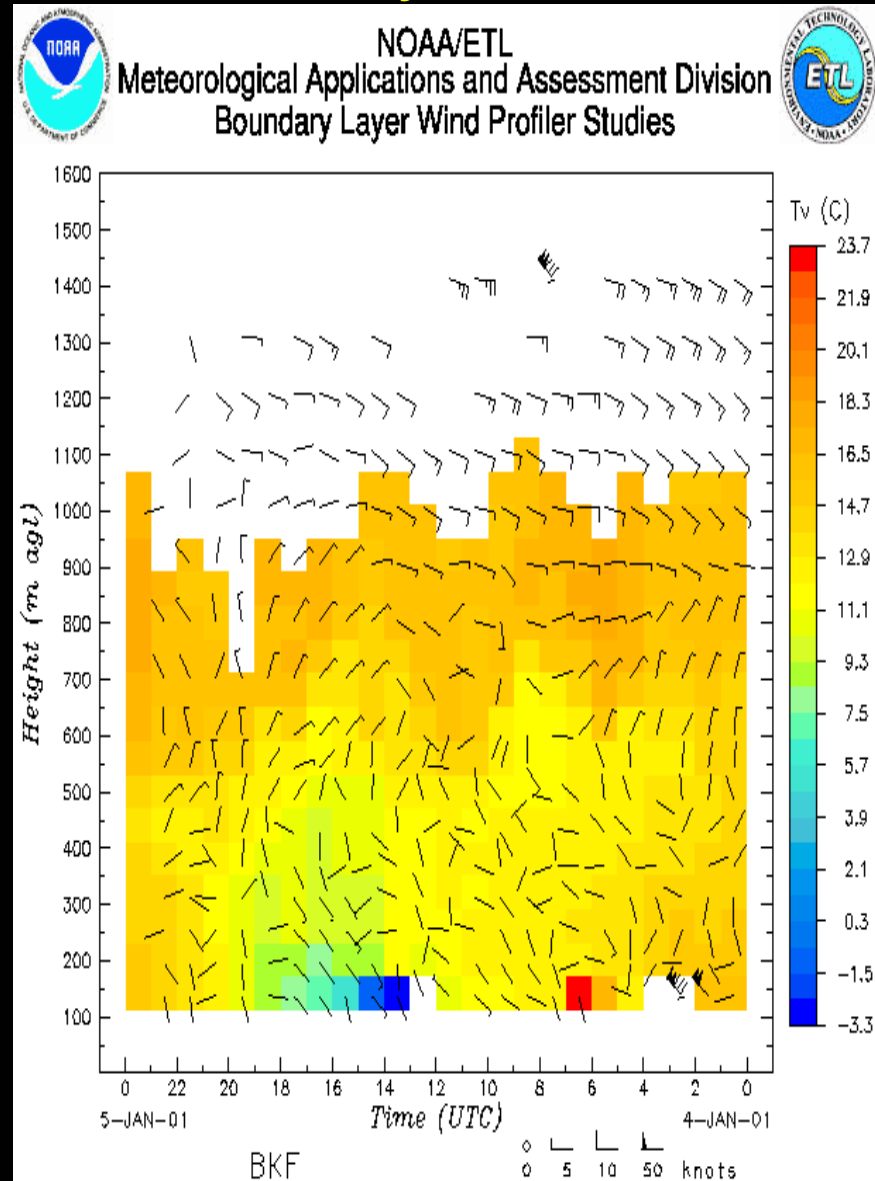
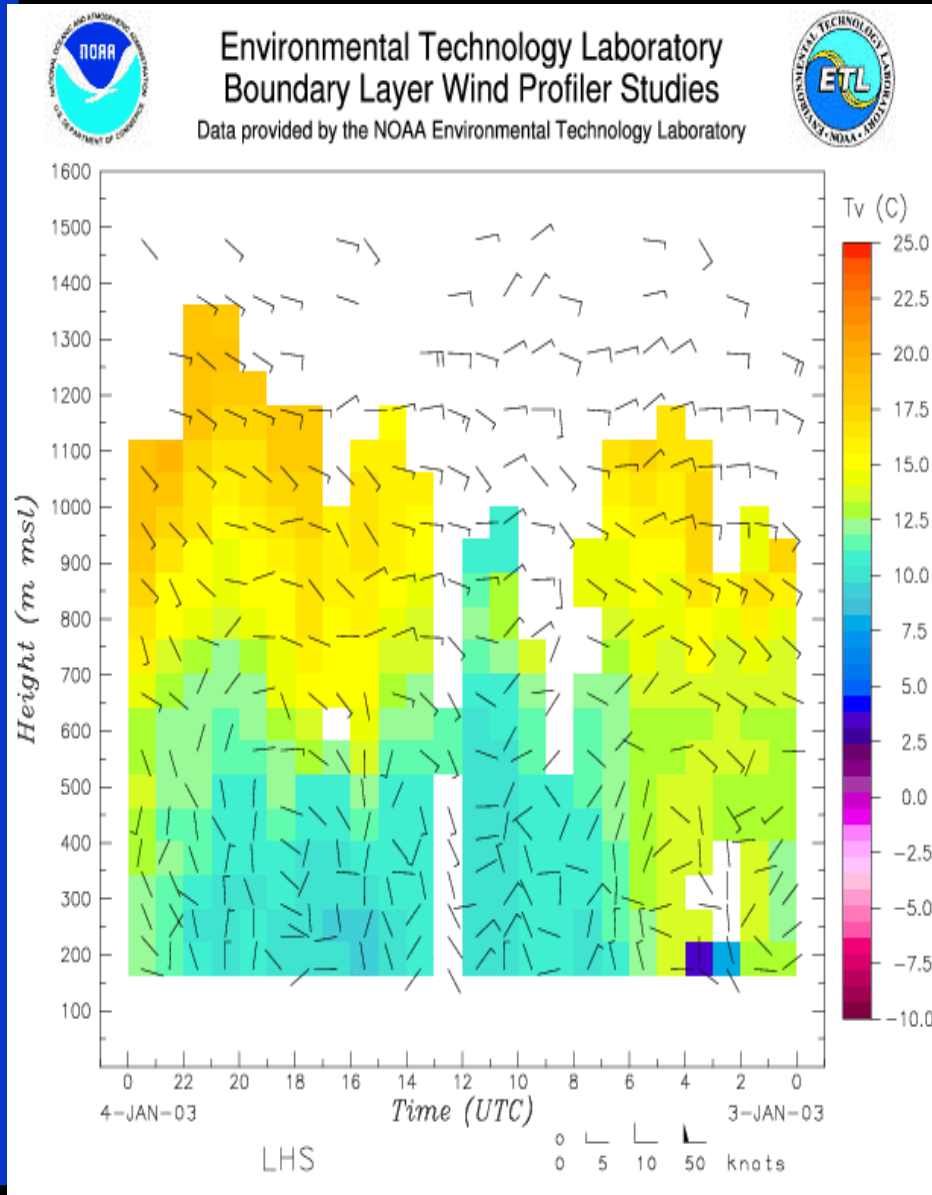
Form View

NUM

Lower Air Profiler Data

Lost Hills January 4, 2003

Bakersfield January 3, 2001

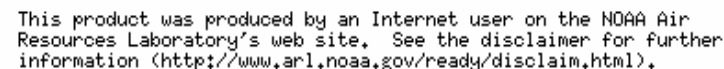


Basis for Five Day CRPAQS PM Forecast

- Next Day PM10 forecast by regression then intuitively adjusted accounting for synoptic model performance and measured PM trends
- Ramped up and down by analysis of synoptic model patterns and regression parameters (e.g.--T850-min)
- PM2.5 forecast calculated by averaging measured PM2.5/10 ratios over the last 5 days at each site then intuitively adjusted



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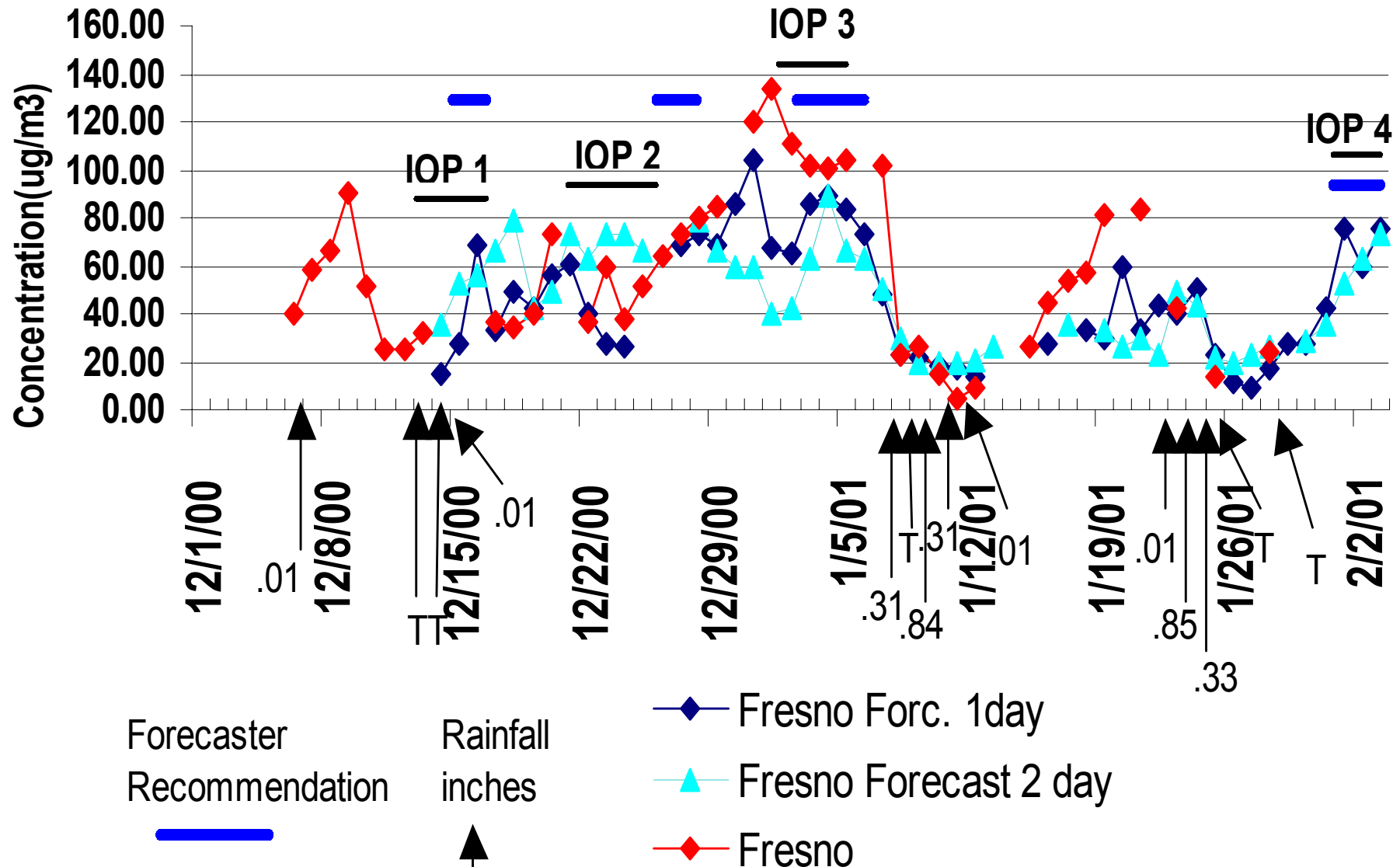
GRID POINT: 45.02 40.95 LAT.: 36.77 LON.: -119.72

AVN 191 km

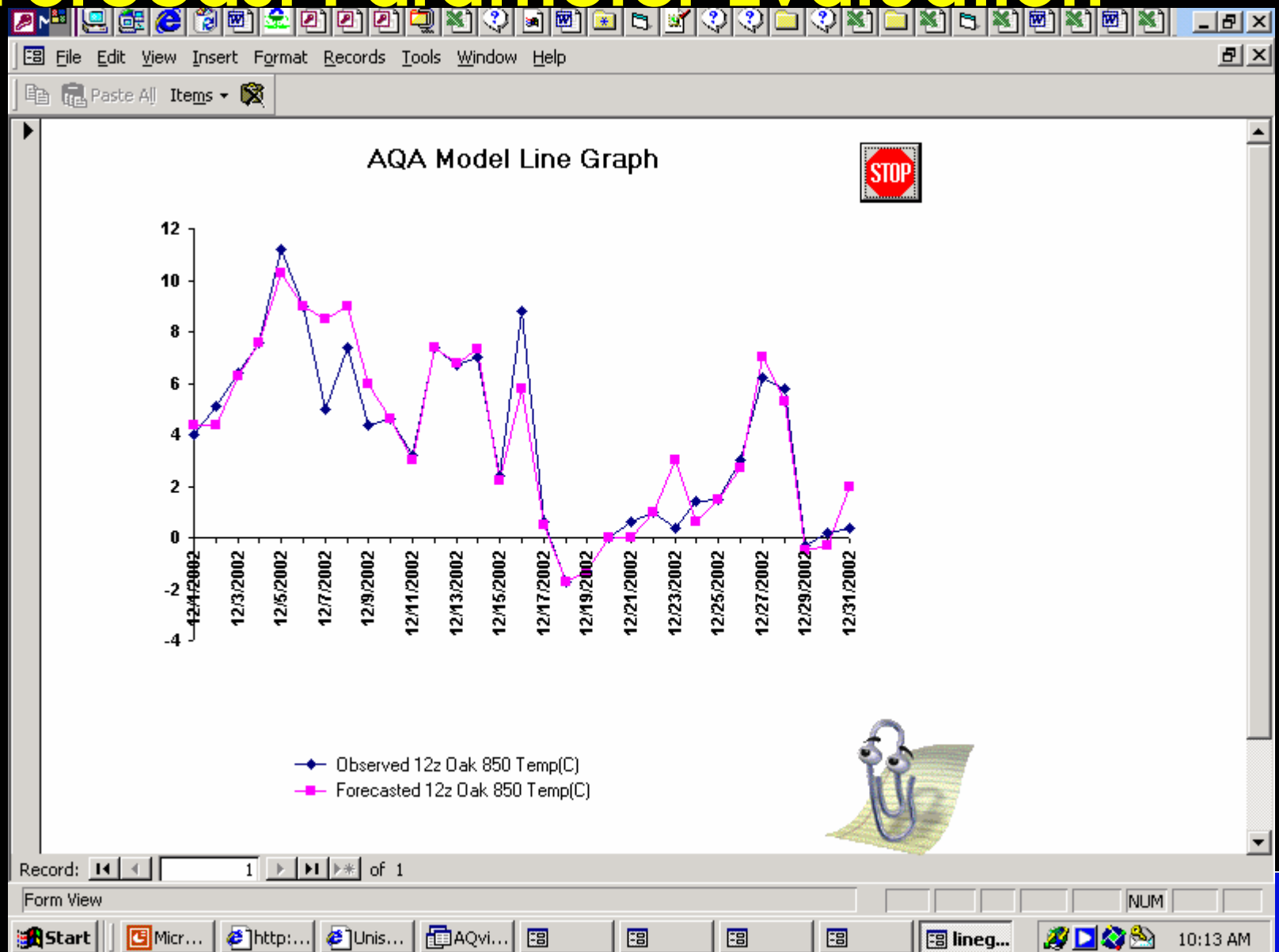
MODEL INITIALIZATION AT: 29 JAN 2003 12Z



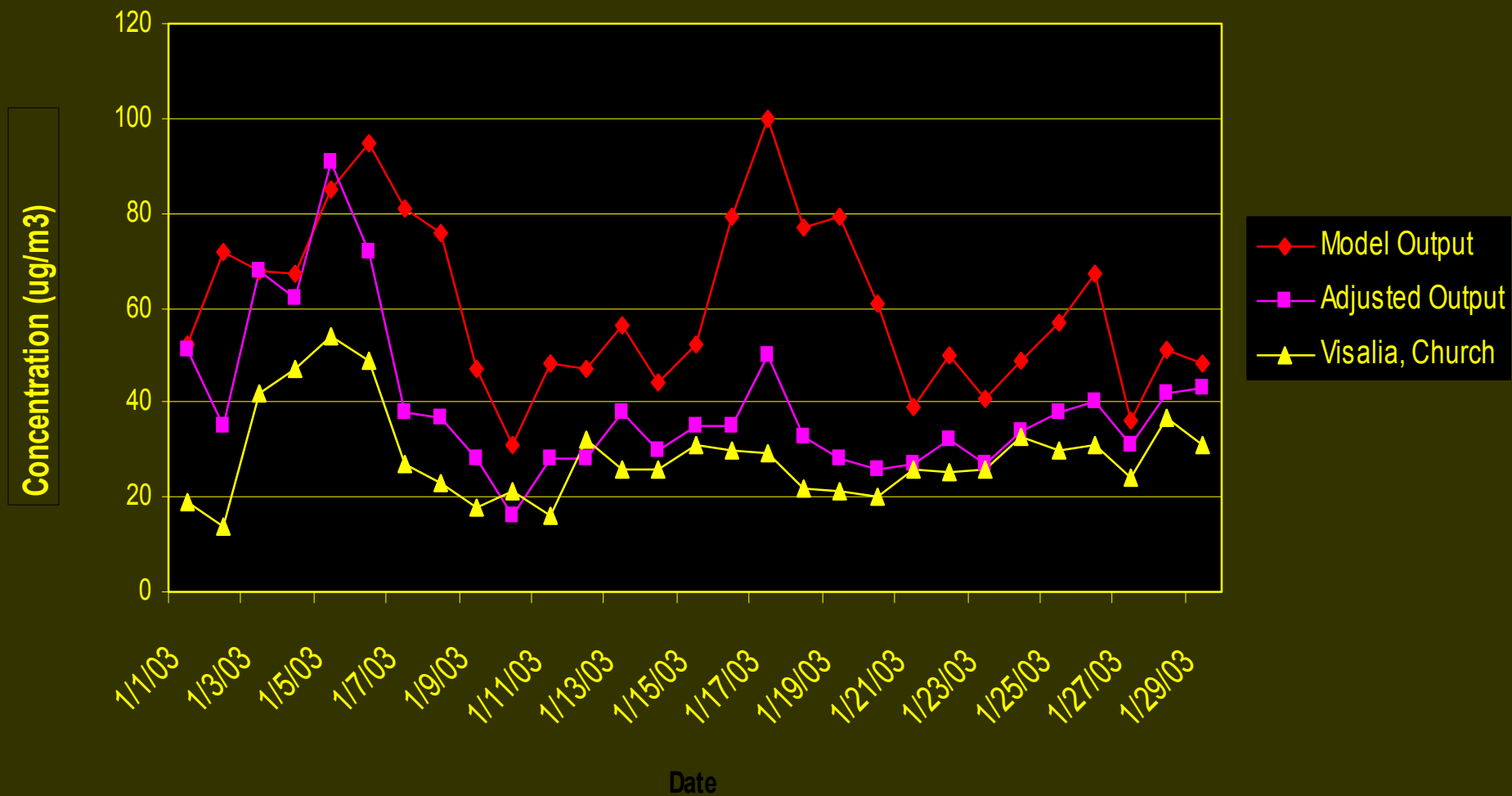
Fresno-One and Two Day PM2.5 Forecasts



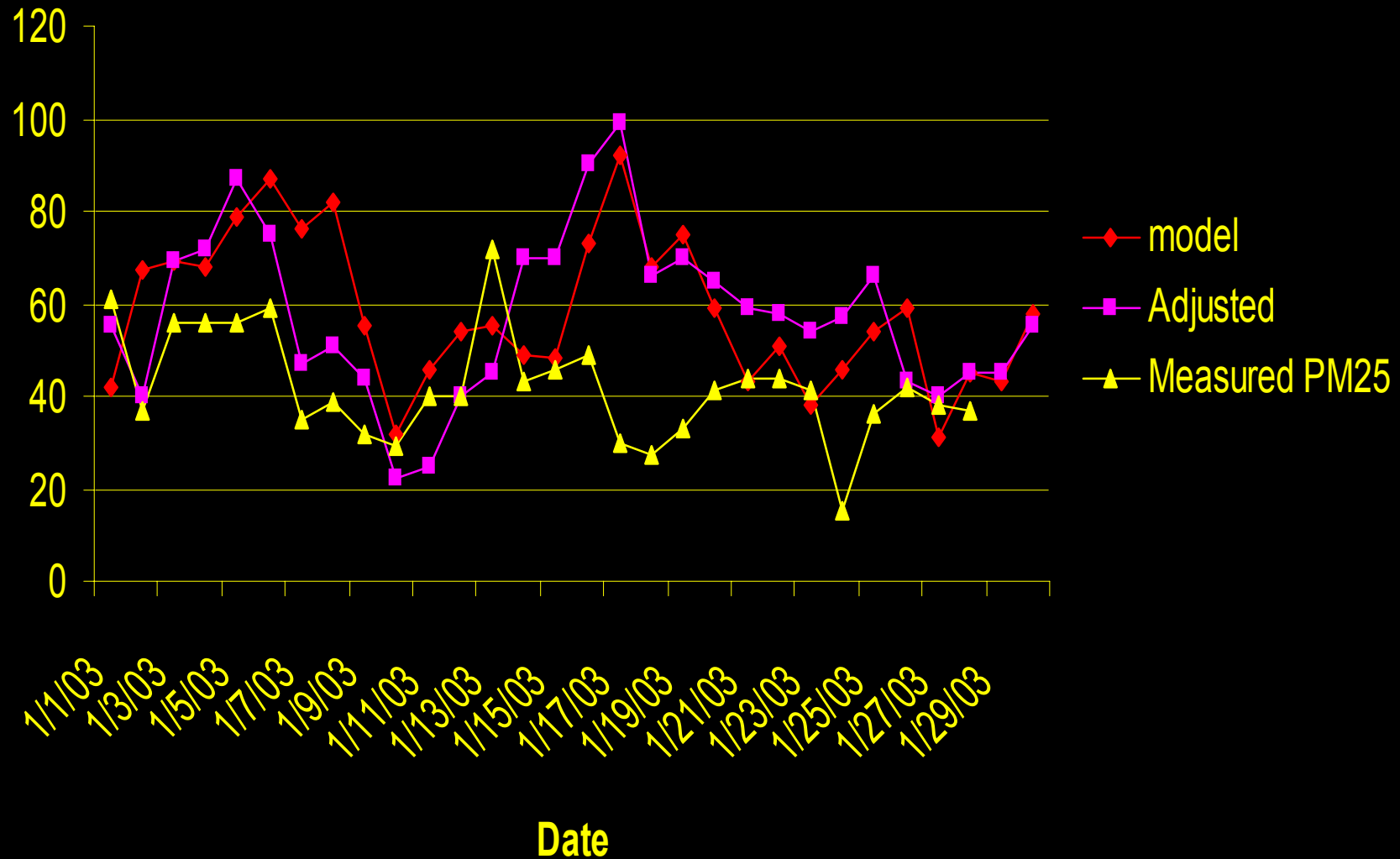
Forecast Parameter Evaluation



January 2003 PM2.5 Forecasts at Visalia



January 2003 PM2.5 Forecasts at Fresno-1st Street



Synoptic Discussion:

Surface: The morning surface chart indicate strong highs centered over the Four Corners Region and 500 NM southwest of Point Conception. A cold front curves southward along the West Coast from British Columbia to 600 NM west of San Francisco.

Aircraft Sounding: The morning aircraft sounding from Modesto shows a warmer air mass, with a strong inversion of 23 degrees Fahrenheit from the surface up to 3,000 feet.

Upper: Upper level charts a strong high 700 NM west of northern Baja, with a ridge building northeastward into the Great Basin.

Air Quality Forecast:

A weak upper level disturbance will move into the Pacific Northwest during the next 24 hours, with very minimal impact on the Valley Floor. High pressure will strengthen across the Region on Sunday, with deteriorating dispersion conditions into early next week. Pollutants will steadily climb through the period, with the dominant pollutant being PM2.5 or 10 depending on location. AQI will be high unhealthy for sensitive groups in the northern region and unhealthy in the central and southern regions.

Burn Day Forecast:

In all three regions, a no burn day will be declared tomorrow due to poor dispersion conditions. Strong stability aloft and light wind flow will lead to minimal smoke dispersion, thus resulting in a NO BURN DAY. In all three regions, an exceedance of the National Ambient Air Quality Standard for PM10 is not forecast for tomorrow.

Please Don't Light Tonight:

Atmospheric dispersion conditions will be marginal tonight. Forecast PM10 and PM2.5 will not exceed PDLT criteria, as a result a Please Don't Light Tonight **will not be declared in all three regions tonight through 400 PM tomorrow afternoon.** Residential wood burning may lead to elevated levels on a small impact scale tonight.



Conclusions and Recommendations

- Generally cannot forecast the worst events
- Weather models generally too fast with trough cleanout
- Very rigorous systems were required to clean the San Joaquin Valley
- Factors such as wet deposition need to be addressed
- More real-time data needed including components of PM_{2.5}

